2020 Watershed Characterization Report

Upper River Basin Streams
&
Middle Nueces River

May 2020

Prepared in cooperation with the Texas Commission on Environmental Quality
Clean Rivers Program
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## List of Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>AU</td>
<td>Assessment Unit</td>
</tr>
<tr>
<td>ALM</td>
<td>Aquatic Life Monitoring</td>
</tr>
<tr>
<td>BCRAGD</td>
<td>Bandera County River Authority and Groundwater District</td>
</tr>
<tr>
<td>BMP</td>
<td>Best Management Practices</td>
</tr>
<tr>
<td>CAFO</td>
<td>Concentrated Animal Feeding Operations</td>
</tr>
<tr>
<td>cfu</td>
<td>Colony Forming Units</td>
</tr>
<tr>
<td>CR</td>
<td>County Road</td>
</tr>
<tr>
<td>CRP</td>
<td>Clean Rivers Program</td>
</tr>
<tr>
<td>CWQM</td>
<td>Continuous Water Quality Monitoring</td>
</tr>
<tr>
<td>DDE</td>
<td>Dichlorodiphenylethylene</td>
</tr>
<tr>
<td>DO</td>
<td>Dissolved Oxygen</td>
</tr>
<tr>
<td>DOJ</td>
<td>Department of Justice</td>
</tr>
<tr>
<td>DSHS</td>
<td>Department of State Health Services</td>
</tr>
<tr>
<td>FM</td>
<td>Farm to Market</td>
</tr>
<tr>
<td>Hr</td>
<td>Hour</td>
</tr>
<tr>
<td>IH</td>
<td>Interstate Highway</td>
</tr>
<tr>
<td>IR</td>
<td>Integrated Report</td>
</tr>
<tr>
<td>km</td>
<td>Kilometers</td>
</tr>
<tr>
<td>LDS</td>
<td>Least Disturbed Stream</td>
</tr>
<tr>
<td>m</td>
<td>Meters</td>
</tr>
<tr>
<td>mg/l</td>
<td>Milligrams Per Liter</td>
</tr>
<tr>
<td>mL</td>
<td>Milliliter</td>
</tr>
<tr>
<td>MPN</td>
<td>Most Probably Number</td>
</tr>
<tr>
<td>NCR</td>
<td>Non-Contact Recreation</td>
</tr>
<tr>
<td>NRA</td>
<td>Nueces River Authority</td>
</tr>
<tr>
<td>PCB</td>
<td>Polychlorinated biphenyl</td>
</tr>
<tr>
<td>PCR</td>
<td>Primary Contact Recreation</td>
</tr>
<tr>
<td>RR</td>
<td>Ranch Road</td>
</tr>
<tr>
<td>RRC</td>
<td>Railroad Commission of Texas</td>
</tr>
<tr>
<td>RUAA</td>
<td>Recreational Use Attainability Analysis</td>
</tr>
<tr>
<td>SCR1</td>
<td>Secondary Contact Recreation 1</td>
</tr>
<tr>
<td>SCR2</td>
<td>Secondary Contact Recreation 2</td>
</tr>
<tr>
<td>SH</td>
<td>State Highway</td>
</tr>
<tr>
<td>su</td>
<td>Standard Units</td>
</tr>
<tr>
<td>SWQM</td>
<td>Surface Water Quality Monitoring</td>
</tr>
<tr>
<td>SWQMIS</td>
<td>Surface Water Quality Monitoring Information System</td>
</tr>
<tr>
<td>TCEQ</td>
<td>Texas Commission on Environmental Quality</td>
</tr>
<tr>
<td>TIAER</td>
<td>Texas Institute of Applied Environmental Research</td>
</tr>
<tr>
<td>TMDL</td>
<td>Total Maximum Daily Load</td>
</tr>
<tr>
<td>TPWD</td>
<td>Texas Parks and Wildlife Department</td>
</tr>
<tr>
<td>TSS</td>
<td>Total Suspended Solids</td>
</tr>
<tr>
<td>TSSWCB</td>
<td>Texas State Soil and Water Conservation Board</td>
</tr>
<tr>
<td>µg/l</td>
<td>Micrograms Per Liter</td>
</tr>
<tr>
<td>US</td>
<td>United States (Highway)</td>
</tr>
<tr>
<td>WPP</td>
<td>Watershed Protection Plan</td>
</tr>
<tr>
<td>WWTP</td>
<td>Wastewater Treatment Plant</td>
</tr>
</tbody>
</table>
1.0 INTRODUCTION and 2019 HIGHLIGHTS

1.1 Introduction
In 1991, the Texas Legislature passed the Texas Clean Rivers Act requiring basin-wide water quality assessments to be conducted for each river basin in Texas. Under this act, the Clean Rivers Program (CRP) has developed an effective partnership involving the Texas Commission on Environmental Quality (TCEQ), other state agencies, river authorities, local governments, industry, and citizens. Using a watershed management approach, the Nueces River Authority (NRA) and TCEQ work together to identify and evaluate surface water quality issues and to establish priorities for corrective action. Under CRP, NRA is responsible for the San Antonio – Nueces Coastal Basin, the Nueces River Basin, the Nueces – Rio Grande Coastal Basin, and the adjacent bays and estuaries, an area roughly 31,500 square miles, ranging from the hill country in Edwards County to San Antonio Bay in Refugio County to the Brownsville Ship Channel in Cameron County. (Figure 1.1)

![NRA’s Basins of Responsibility](image)

Nueces River Basin
The Nueces River Basin covers approximately 17,000 square miles, encompassing all or part of 23 counties in South-Central Texas. Other rivers within the basin include the Frio, Leona, Sabinal, and Atascosa Rivers. The basin is bordered by the Colorado, Guadalupe, and San Antonio River Basins to the north, the San Antonio – Nueces Coastal Basin to the southeast, the Nueces – Rio Grande Coastal Basin to the south, and the Rio Grande River basin to the south and southwest. Throughout the basin, the rivers are used for water supply and recreational purposes. The basin is home to numerous state-operated recreational areas including: Choke Canyon State Park on the south side of Choke Canyon Reservoir near Three Rivers, Lake Corpus Christi State Park on the southeast bank of Lake Corpus Christi near Mathis, Garner State Park north of Concan, Tips State Recreational Area on the Frio River in Three Rivers, Lipantitlan State Historic Park near Sandia, Lost Maples State Natural Area north of Vanderpool, and Hill Country State Natural Area north of Hondo.

1.2 2019 Highlights
2019 was a record-breaking year in the Nueces River Basin. Numerous significant flood events occurring in the Upper Nueces River watershed during the second half of 2018 resulted in a lot of recharge to groundwater levels that supply the rivers. In typical years, only flood waters from the upper basin make it down to the lower basin but 2018/2019 marked in the longest span of continuous flows since the 1970s. Consistently flowing water allowed for the completion Aquatic Life Monitoring (ALM) projects on the middle Nueces and upper Frio rivers as well as 24-hour dissolved oxygen monitoring on the middle Nueces River.
2.0 WATER QUALITY MONITORING

In general, the CRP and Surface Water Quality Monitoring (SWQM) programs conduct quarterly monitoring at routine monitoring sites. Most of these sites have been monitored for many years and provide valuable information with respect to trends and/or changing conditions. Routine water quality samples are analyzed for conventional and bacteria parameters. These samples are usually collected four times per year, once per quarter. Field parameters are also recorded as part of the sampling events.

Parameters analyzed for conventional monitoring include alkalinity, ammonia, total dissolved solids (TDS), total suspended solids (TSS), total phosphorous, chlorides, sulfate, hardness (fresh-water sites), nitrates, chlorophyll-a, pheophytin, and total organic carbon.

Routine bacteria analysis includes enterococcus in saltwater bodies and tidal segments and E. coli for freshwater sites. Additional bacterial analysis is being conducted for some of the special studies. These studies are discussed in Section 3.2, Watershed Summaries.

Measured field parameters in the NRA CRP include dissolved oxygen (DO), salinity (saltwater and tidal sites), flow (freshwater sites), pH, water temperature, air temperature, conductivity, secchi depth, and wind speed and direction. Observations such as water color, water odor, surface conditions, turbidity, current weather, recent rainfall amounts, and evidence of primary contact recreation are noted.

Low DO concerns are more thoroughly evaluated with 24-Hour (Hr) DO measurements. This monitoring is conducted when adequate flow conditions exist.

Specific sites and the type of monitoring being conducted are listed in summary tables at the beginning of each basin subsection within Section 3.2. Detailed information is available on the Statewide Coordinated Monitoring Schedule, http://cms.lcra.org/, maintained by the Lower Colorado River Authority.
3.0 WATER QUALITY CONDITIONS

3.1 Water Quality Terminology
This Watershed Characterization report discusses the status of water quality conditions in the upper portions of the Nueces River Watershed and middle Nueces River segments. For each segment, the report includes:

- A description of the stream segment and its watershed
- Hydrologic characteristics of the stream
- Map of the watershed that includes sampling location and land use information
- A water quality summary for each Assessment Unit (AU) in the stream segment
- Discussion of land use in the watershed
- Discussion of possible causes of water quality impairments and/or concerns
- Local Stakeholders
- Recommendations to improve water quality

Data used in this report comes from the results of water quality monitoring that is conducted by TCEQ through TCEQs Surface Water Quality Monitoring (SWQM) program and by Nueces River Authority through the Clean Rivers Program (CRP). This report uses the most recent data available, TCEQs 2020 Integrated Report. The report assesses a variety of parameters including DO, pH, water temperature, total phosphorus, nitrates, ammonia, chlorophyll-a, and bacteria (E.coli for fresh water segments and Enterococcus on tidal and marine segments) values on each assessment unit (AU) of a classified segment where ample data were available. Metals data were assessed where applicable. A single stream segment can consist of one to several AUs. TDS, chloride, and sulfate are assessed for the entire segment and only on freshwater segments. AU boundaries are occasionally modified to be more representative and provide for a more accurate analysis. Integrated Reports include data for a 7-year period and are updated every 2 years. In most cases, a minimum of 10 samples is required to conduct the assessment. In some cases, the 10 samples are obtained by using a slightly longer period of time. The 2020 Integrated Report includes data from December 1, 2011 through November 30, 2018. Prior to 2010, water quality assessments conducted by the TCEQ were called the Water Quality Inventory.

Impairments for the following parameters are defined as follows:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Criteria</th>
<th>Calculation Used for Impairment*</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDS, chloride, and sulfate</td>
<td>Segment specific</td>
<td>Average of samples are above the criteria</td>
</tr>
<tr>
<td>DO (for High Aquatic Life Use)</td>
<td>3.0 mg/l** grab sample 5.0 mg/l 24-Hr average or Segment specific</td>
<td>10% of samples are below either criteria</td>
</tr>
<tr>
<td>pH</td>
<td>6.5 su*** and 9 su</td>
<td>10% of samples are above or below the criteria</td>
</tr>
<tr>
<td>Bacteria (E. coli)</td>
<td>126 cfu****</td>
<td>Geometric mean is greater than the criteria</td>
</tr>
</tbody>
</table>

*The percent of samples exceeding the criteria or screening level varies somewhat with small sample sizes (between 10 and 20). When sample sizes are greater than 20 samples, the percentage shown in the calculation column is much more accurate.

**mg/l: milligrams per liter
***su: standard units
****cfu: colony forming units

Concerns for the following parameters are defined as follows:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Screening Levels*</th>
<th>Calculation Used for Concern</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stream</td>
<td>Reservoir</td>
</tr>
<tr>
<td>Ammonia-Nitrogen</td>
<td>0.33 mg/l</td>
<td>0.11 mg/l</td>
</tr>
<tr>
<td>Nitrate</td>
<td>1.95 mg/l</td>
<td>0.37 mg/l</td>
</tr>
<tr>
<td>Total phosphorus</td>
<td>0.69 mg/l</td>
<td>0.20 mg/l</td>
</tr>
<tr>
<td>Chlorophyll-a</td>
<td>14.1 µg/l**</td>
<td>26.7 µg/l</td>
</tr>
</tbody>
</table>

*Screening levels to identify concerns have been developed by the State to enable an assessment of water quality for some parameters, primarily nutrients that only have a narrative criteria. The levels were developed by calculating the 85th percentile for all water quality data in the TCEQ's water quality database over a 10-year period.

**µg/l: micrograms per liter
The following chart explains the potential causes and impacts when water quality standards are not met.

<table>
<thead>
<tr>
<th>Parameter of Concern or Impairment</th>
<th>Cause</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>DO</td>
<td>Modifications to the riparian zone, human activity that causes water temperatures to increase, and increases organic matter, bacteria, and over abundant algae.</td>
<td>Organisms that live in water need oxygen to live. In waters with depressed DO levels, organism may not have sufficient oxygen to survive.</td>
</tr>
<tr>
<td>pH</td>
<td>Industrial and wastewater discharge, runoff from quarry operations, and accidental spills.</td>
<td>Most aquatic life is adapted to live within a narrow pH range. Different organisms can live and adjust to differing pH ranges, but all fish die if pH is below 4 (the acidity of orange juice) or above 12 (the pH of ammonia).</td>
</tr>
<tr>
<td>Ammonia</td>
<td>Ammonia is excreted by animals and is produced during the decomposition of plants and animals. It is an ingredient in many fertilizers and is also present in sewage, storm water runoff, certain industrial wastewaters, and runoff from animal feedlots.</td>
<td>Elevated levels of ammonia in the environment can adversely affect fish and invertebrate reproductive capacity and reduced growth of the young.</td>
</tr>
<tr>
<td>Nutrients</td>
<td>Nutrients are found in effluent released from wastewater treatment plants (WWTP)s, fertilizers, and agricultural runoff carrying animal waste from farms and ranches. Soil erosion and runoff from farms, lawns, and gardens can add nutrients to the water.</td>
<td>These nutrients increase plant and algae growth. When plants and algae die, the bacteria that decompose them use oxygen so that is no longer available for fish and other living aquatic life. The more dead plants in the water, the more bacteria are produced to decompose the dead leaves. High levels of nitrate and nitrates can produce Nitrite Toxicity, or “brown blood disease,” in fish. This disease reduces the ability of blood to transport oxygen throughout the body.</td>
</tr>
<tr>
<td>Nitrates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total phosphorus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlorophyll-a</td>
<td>Modifications to the riparian zone, human activity that causes water increases in organic matter, nutrients, bacteria, and over abundant algae.</td>
<td>Chlorophyll-a is the photosynthetic pigment found in all green plants, algae, and cyanobacteria. Elevated levels indicate abundant plant growth which could lead to reduced DO levels.</td>
</tr>
<tr>
<td>TSS</td>
<td>TSS originates from multiple point and nonpoint sources but most commonly results from erosion of soils substrates. A good measure of the upstream land use conditions is how much TSS rises after a heavy rainfall.</td>
<td>TSS measures the amount of particles that are suspended in water and which will not pass through a filter. It can also affect light penetration. Deposition of these particles can bury and/or destroy benthic habitat for most species of aquatic insects, snails and crustaceans.</td>
</tr>
<tr>
<td>TDS</td>
<td>Mineral springs, carbonate deposits, salt deposits, and sea water intrusion are natural sources of these parameters. Other sources can be attributed to oil exploration, drinking water treatment chemicals, storm water and agricultural runoff, and wastewater discharges.</td>
<td>High levels of these parameters may affect the aesthetic quality of water, interfering with washing clothes and corroding plumbing fixtures. They can also affect the permeability of ions in aquatic organisms.</td>
</tr>
</tbody>
</table>
Recreational Use Designations

Below is a breakdown of definitions of each designation and corresponding bacterial concentrations.

**Primary contact recreation (PCR):** Water recreation activities, such as wading by children, swimming, water skiing, diving, tubing, surfing, and whitewater kayaking, canoeing, and rafting, involving a significant risk of ingestion of water. For *E. coli*, the geometric mean criterion is 126 cfu per 100 milliliters of sampled water; for Enterococcus, the geometric mean criterion is 35 cfu per 100 milliliters of sampled water.

**Secondary contact recreation 1 (SCR1):** Water recreation activities, such as fishing, commercial and recreational boating, and limited body contact incidental to shoreline activity, not involving a significant risk of water ingestion and that commonly occur. For *E. coli*, the geometric mean criterion is 630 cfu per 100 milliliters of sampled water; for Enterococcus, the geometric mean criterion is 175 colonies per 100 milliliters of sampled water.

**Secondary contact recreation 2 (SCR2):** Water recreation activities, such as fishing, commercial and recreational boating, and limited body contact incidental to shoreline activity, not involving a significant risk of water ingestion but that occur less frequently than for secondary contact recreation 1 due to (1) physical characteristics of the water body and/or (2) limited public access. For *E. coli*, the geometric mean criterion is 1030 cfu per 100 milliliters of sampled water.

**Noncontact recreation (NCR):** Activities, such as ship and barge traffic, birding, and using hike and bike trails near a water body, not involving a significant risk of water ingestion, and where primary and secondary contact recreation should not occur because of unsafe conditions. For *E. coli*, the geometric mean criterion is 2,060 cfu per 100 milliliters of sampled water; for Enterococcus, the geometric mean criterion is 350 cfu per 100 milliliters of sampled water.

<table>
<thead>
<tr>
<th>Recreational Use Designations</th>
<th>E. coli (Freshwater) cfu/100 mL</th>
<th>Enterococcus (Salt Water) cfu/100 mL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Contact Recreation</td>
<td>126</td>
<td>35</td>
</tr>
<tr>
<td>Secondary Contact 1</td>
<td>630</td>
<td>175</td>
</tr>
<tr>
<td>Secondary Contact 2</td>
<td>1030</td>
<td>*</td>
</tr>
<tr>
<td>Noncontact Recreation</td>
<td>2060</td>
<td>350</td>
</tr>
</tbody>
</table>

*There is no Secondary Contact 2 designation for Enterococcus.*

Recreational Use Attainability Analysis (RUAA)

In order to determine the appropriate designation, a Recreational Use Attainability Analysis (RUAA) must be conducted. An RUAA is designed to: capture information of the types of recreational uses occurring in a water body; document physical stream characteristics that affect recreational uses; and document observed, historical, and anecdotal recreational uses. The information is obtained via questionnaires, field surveys, and research. Until an RUAA is conducted and a designation other than primary contact recreation is found to be more appropriate, a segment will continue to be assessed using the primary contact recreation criteria.

Aquatic Life Monitoring (ALM)

Aquatic Life Monitoring (ALM) is a type of monitoring that’s used to derive baseline data on fish communities, benthic macroinvertebrate communities, and physical habitat to determine if designated or presumed aquatic life uses are being attained and/or are appropriate for the waterbody. ALM activities include fish and aquatic invertebrate collection, habitat assessment, 24-hour dissolved oxygen data collection, and water chemistry analysis. Typically, two biological events are required over one year. One event is to be conducted during the critical period (July 1 - September 30) and the other event during the non-critical portion of the index period March 15 - June 30 or October 1 – October 15) with, at least one month between monitoring events. ALMs were conducted in two river segments (2104 and 2113) in 2019 to address biological impairments.

Least Disturbed Stream (LDS)

Least Disturbed Stream (LDS) monitoring is a type of ALM that is conducted in streams to define reference conditions for Texas streams and represent the “best available” streams in each of the ecoregions in Texas. LDS studies serve as the basis for developing benchmarks against which a biological monitoring program can assess the biological condition of test sites. LDS studies were conducted on Segment 2105 – Nueces River above Holland Dam in 2018.
3.2 Watershed Summary of the Nueces River Watershed

This section contains detailed information for the Upper Nueces Basin and Middle Nueces River. Information included for each of the basins contains a map of the basin, a description of the basin, a summary of concerns and impairments identified in the 2020 Integrated Report, a table of the FY 2020 sampling locations, and summaries for each segment within the basin.

The summaries for each segment include a map, a description of the watershed, a concern and impairment discussion, and data relating to each concern and impairment. Appendix A contains a list of all wastewater discharge permits.

The map shows the segment boundaries; includes land use/land cover information of the contributing watershed; the location of sampling sites, WWTPs, and confined animal feeding operations (CAFO); the names of nearby cities and major roads; and an inset of the watershed's location within the basin. Figure 3-1 is a sample map.
Land Use and Land Cover

The land use/land cover data for this report was obtained from the 2006 National Land Cover Database of the USGS. The land use/land cover categories for National Landcover Database (NLCD) are described in (Homer et al., 2004) as the following:

- **Shrub/Scrub** – Shrub/Scrub—Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20 percent of total vegetation. This class includes true shrubs, young trees in an early successional stage, or trees stunted from environmental conditions.
- **Hay/Pasture** - Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.
- **Cultivated Crops** – Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being actively tilled.
- **Developed, Open Space** – Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.
- **Developed, Low Intensity** - Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20–49 percent of total cover. These areas most commonly include single-family housing units.
- **Developed Medium Intensity** – Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50–79 percent of the total cover. These areas most commonly include single-family housing units.
- **Developed High Intensity** – Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80-100% of the total cover.
- **Deciduous Forest** – Areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.
- **Woody Wetlands** – Areas where forest or shrubland vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
- **Herbaceous** – Areas dominated by grammanoid or herbaceous vegetation, generally greater than 80 percent of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.
- **Evergreen Forest** – Areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.
- **Emergent Herbaceous Wetlands** – Areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
- **Barren Land** – Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits, and other accumulations of earthen material. Generally, vegetation accounts for less than 15 percent of total cover.
- **Mixed Forest** – Areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.
- **Open Water** – All areas of open water, generally with less than 25 percent cover of vegetation or soil.
3.2.2 NUECES BASIN (Figure 3-2)

The Nueces River Basin originates in Edwards County and extends approximately 315 miles to Nueces Bay near Corpus Christi. The basin is bordered by: the Colorado, Guadalupe, and San Antonio River Basins to the north; the San Antonio – Nueces Coastal Basin to the southeast; the Nueces – Rio Grande Coastal Basin to the south, and the Rio Grande River basin to the south and southwest. The total basin drainage area covers approximately 17,000 square miles, encompassing all or part of 23 counties in South-Central Texas. Rivers within the basin include the Atascosa River, the Frio River and its tributaries (San Miguel Creek, Hondo Creek, Sabinal River, and Leona River), and the Nueces River and its tributaries.

![Figure 3-2. Rivers in the Nueces River Basin](image)

**Water Quality Overview**

The headwaters of the Nueces River Basin begin in Edwards, Real, and Bandera counties in the Edwards Plateau and include several spring fed creeks and rivers including the Nueces, Frio, and Sabinal rivers. Very few water quality concerns or impairments exist in this area. As the Nueces and its tributaries flow through the Southern Texas Plains, streamflow becomes increasingly dependent on precipitation events. Soils become finer and sediment loads build increasing turbidity. Salts and other minerals increase in concentration under low stream flow conditions. In times of moderate or extreme drought conditions, flows in the Nueces and Frio rivers may stop completely. Biological communities survive in isolated pools until flows resume. Dissolved Oxygen (DO) concentrations can be very low, especially in the summer months where high temperatures decrease available oxygen to fish and other aquatic species. Impairments for bacteria also exist throughout the basin – the common causes being failing on-site sewage facilities (OSSF), wildlife, and feral hogs.
The Nueces River Basin covers approximately 17,000 square miles, encompassing all or part of 23 counties in South-Central Texas. Other rivers within the basin include the Frio, Leona, Sabinal, and Atascosa Rivers. Surface water quality monitoring in the Upper and Middle Nueces River Basin is a joint effort between the TCEQ Region 16 – Laredo Field Office, TCEQ Region 13 – San Antonio Field Office, Bandera County River Authority and Groundwater District (BCRAGD) and the Nueces River Authority (NRA).

There are several TMDLs that have been conducted in the basin: Segment 2104, Nueces River above Frio River, for depressed DO; and Segment 2110, Lower Sabinal River, for nitrates.

Figure 3.3 lists all the CRP and SWQM sites monitored during FY 2019 in this basin.
Segment 2104: Nueces River Above Frio River

The middle Nueces River winds its way through a portion of Texas known at the "Wildhorse Desert". A relative lack of topography combined with finer sediments results in a gently flowing but turbid stream. The upper reaches of this segment are also known as the “braided reach” due to a network of flood relief channels that crisscross each other during high flow events. Pools left behind after floods provide refuge to wildlife and aquatic species.

Segment Description
Segment 2104, Nueces River above Frio River, flows from Holland Dam in La Salle County to its confluence with the Frio River in Live Oak County near the town of Three Rivers. The segment is approximately 91 miles long and its watershed is 1,876,877 acres. The middle Nueces River is underlain by Cretaceous chalk, clay, and limestone beds that contributes turbidity to surface water flows.

<table>
<thead>
<tr>
<th>Segment Name</th>
<th>Station ID</th>
<th>AU</th>
<th>AU Description</th>
<th>Monitoring Entity</th>
<th>Sampling Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2104 Nueces River Above Frio River</td>
<td>12972</td>
<td>01</td>
<td>From the downstream end of the segment to the confluence of Dragon Creek</td>
<td>NRA</td>
<td>Routine Quarterly</td>
</tr>
<tr>
<td>12973</td>
<td></td>
<td>02</td>
<td>From the confluence of Dragon Creek to the confluence of Guadalupe Creek</td>
<td>NRA</td>
<td>Routine Quarterly</td>
</tr>
<tr>
<td>12974</td>
<td></td>
<td>03</td>
<td>From the confluence of Guadalupe Creek to Holland Dam</td>
<td>NRA</td>
<td>24-hour Dissolved Oxygen Monitoring</td>
</tr>
</tbody>
</table>

Hydrologic Characteristics
Streamflow in Segment 2104 is largely influenced by local storm events and runoff from flood events originating from the upper Nueces River. Flood flows from the headwaters of the upper Basin take approximately one week to flow downstream to the beginning of the segment below Holland Dam. Flood flows then take approximately 10 days to traverse Segment 2104. During periods of moderate drought, streamflow drops to zero with intermittent pools providing refuge for aquatic species. During periods of extreme drought, much of the riverbed goes dry. Maximum discharge of the Nueces River at Three Rivers (USGS 08210000) was 141,000 ft³/s in 1967 with the passage of Hurricane Beulah. Median instantaneous flow at the gage is 68 ft³/sec based on 71 years of record.
Water Quality Assessment

Segment 2104 is identified in the 2020 Integrated Report (IR) for not supporting contact recreation and was first listed in the 2018 IR. The segment also has listed concerns for its designated aquatic life use, nitrate, total phosphorus and depressed dissolved oxygen.

<table>
<thead>
<tr>
<th>Segment Name</th>
<th>AU</th>
<th>Impairment</th>
<th>Concern</th>
<th>Response Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>2104 Nueces River Above Frio River</td>
<td>01</td>
<td>Bacteria, 5c</td>
<td>Impaired macrobenthic community, nitrate, total phosphorus</td>
<td>Aquatic Life Monitoring</td>
</tr>
<tr>
<td></td>
<td>02</td>
<td>None</td>
<td>Impaired fish community, impaired macrobenthic community</td>
<td>Aquatic Life Monitoring</td>
</tr>
<tr>
<td></td>
<td>03</td>
<td>None</td>
<td>Dissolved oxygen</td>
<td>24-hour Dissolved Oxygen Monitoring</td>
</tr>
</tbody>
</table>

In Segment 2104_01, the geometric mean of 26 samples of *E. coli* bacteria that were assessed was 143.49 MPN, exceeding the criteria od 126 MPN. The bacteria impairment is currently classified as 5c, meaning more data is needed. Nine out of 28 samples of nitrate failed to meet the nutrient screening level of 1.95 mg/L; the average exceedance value was 16.06 mg/L. Nine out of 28 samples for total phosphorus failed to meet the screening level of 0.69 mg/L; the average exceedance was 1.55 mg/L. The concern for impaired macrobenthic community was addressed by conducting Aquatic Life Monitoring studies in 2017 and 2019 at Station 12972.

In Segment 2104_02, the concern for Impaired fish and macrobenthic community was addressed by conducting Aquatic Life Monitoring studies in 2017 and 2019 at Station 12973. Results of those studies are pending but will likely result in a delisting for that parameter in the 2022 IR.

In Segment 2104_03, the concern for dissolved oxygen is new listing for the 2020 IR. The segment had a listed impairment for the parameter since 2012 but was downgraded to a concern following the results of 24-hour dissolved oxygen monitoring at Station 12974. Monitoring has transitioned to quarterly field only monitoring station following the delisting.

Land Use

Land use in Segment 2104 is predominantly shrub/scrub (68%), hay and pasture (13%), herbaceous (11%), woody wetlands (2%) and cultivated crops (2%) account for much of the land uses. Developed land in the city of Three Rivers accounts for the 2% of the watersheds use. There are two permitted dischargers in the lower end of segment in AU_01; the US Department of Justice (DOJ), and Multi-Chem Group LLC in Three Rivers. Three other dischargers exist in the segment but are not permitted to discharge into the river or its tributaries. These dischargers include Colorado Acres Water Plant, Encinal WSC and the Freer Water Control and Improvement District (WCID).

WQ0013461-001 – US Department of Justice (DOJ): 300,000 gpd
WQ0005091-000 – Multi-Chem Group Three Rives Facility – 11,500 gpd reverse osmosis reject water via 001
WQ0004184-000 – Webb County – Colorado Acres Water Plant: 28,800 gpd via evaporation
WQ0010088-001 – Freer Water Control and Improvement District (WCID): 280,000 gpd via surface irrigation
WQ0013943-001 – Encinal WSC: 95,000 gpd via surfaced irrigation

Possible Causes of Impairments

Streamflow is highly variable in Segment 2104 of the middle Nueces River. Regular intervals of drought cause streamflow to drop to zero creating stagnant pools that inhibit the productivity of fish and macrobenthic communities in AU_01 and AU_02. In AU_01, a WWTP effluent outfall is located approximately 50m upstream of the bridge crossing at Station 12972 in AU_01 where samples are taken and a likely source for nutrient inputs (nitrates and total phosphorus) and possibly bacteria to the river.

Potential Stakeholders

Landowners
Local Government
Texas State Soil and Water Conservation Board
Texas Parks and Wildlife Department
Natural Resource Conservation Service
Texas A&M Agrilife Extension
Recommendations
An evaluation of the procedures at the US Department of Justice (DOJ) WWTP by NRA is recommended. The macrobenthic community impairment will be re-evaluated following the results of the ALM studies that were completed in 2019.

Segment 2104_01 - Nueces River above Frio River - Station 12972
Nueces River at FM-1042 bridge 1.2 miles north of Simmons
Aquatic Life Monitoring (ALM) in the Nueces River above Frio River (Segment 2104)

ALM sampling occurred on the Middle Nueces River (Segment 2104) in Spring 2017 and Summer 2019 to address the concerns for fish and benthic macroinvertebrate communities as listed in the Texas Integrated Report. Nueces Authority Field Staff assisted TCEQs Surface Water Quality Monitoring (SWQM) team and Texas Parks and Wildlife Department (TPWD) in conducting the ALM at the crossing of FM 1042 (Station 12972) and SH-16 south of Tilden (Station 12973). Activities included fish and aquatic invertebrate collection, habitat assessment, 24-hour dissolved oxygen data collection, and water chemistry analysis. Data from the study will be used to re-assess the section of stream to determine if aquatic life uses are being met. Preliminary results of the study indicate a healthy biological community with great potential to remove these segments from the current concern status.
Segment 2104_03 - Nueces River above Frio River - Station 12974
Nueces River at FM-624
Segment 2105 – Nueces River above Holland Dam

The Nueces River above Holland Dam is where water from the Edward’s Plateau slows down to meet the South Texas Plains. The river typically derives much of its flow from flood flows from the upper Nueces River although portions of the segment receive a trickle of spring flow from the Carrizo-Wilcox Aquifer.

Segment Description
Segment 2105, Nueces River above Holland Dam, flows from FM 1025 in Zavala County to Holland Dam in La Salle County. The segment is 78 miles and its watershed covers 2,200,065 acres. The Cities of Crystal City, Carrizo Springs, Asherton, Big Wells, and Cotulla are all in this watershed. Each of these cities has WWTPs that discharge into tributaries of the river.

<table>
<thead>
<tr>
<th>Segment Name</th>
<th>Station ID</th>
<th>AU</th>
<th>AU Description</th>
<th>Monitoring Entity</th>
<th>Sampling Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2105</td>
<td>12975</td>
<td>01</td>
<td>From the downstream end of the segment to the confluence with Sauz Mocho Creek</td>
<td>TCEQ Region 16</td>
<td>Routine Quarterly</td>
</tr>
<tr>
<td></td>
<td>12976</td>
<td>02</td>
<td>From the confluence with Sauz Mocho Creek to the confluence with Line Oak Slough</td>
<td>TCEQ Region 16/NRA</td>
<td>Routine Quarterly/24-hour Dissolved Oxygen</td>
</tr>
<tr>
<td></td>
<td>20156</td>
<td></td>
<td></td>
<td>TCEQ Region 16</td>
<td>Routine Quarterly</td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>03</td>
<td>From the confluence of Live Oak Slough to the upstream end of the segment</td>
<td>N/A</td>
<td>No Current Sampling</td>
</tr>
</tbody>
</table>

Hydrology
Located downstream of the Edwards Plateau, streambed gradients are more gradual, and the floodplain becomes wider than in the upper reaches of the river basin. Streamflow in Segment 2105 varies greatly from year to year and is largely dependent on runoff from localized rain events and from flood flows originating in the upper Nueces River. Much of the segment is underlain by the Carrizo-Wilcox Aquifer which provides flow in upper part of the segment but streamflow typically drops to zero at the lower end of the segment. During periods of moderate...
drought, streamflow drops to zero with intermittent pools providing refuge for aquatic species. During periods of extreme drought, much of the riverbed goes dry.

**Water Quality Assessment**
Segment 2105 is identified in the 2020 IR as impaired for depressed dissolved oxygen. The segment was first listed for not meeting the dissolved oxygen criteria in the 2012 IR. The segment also has concerns for chlorophyll-a. Impairments, concerns, and response actions for the segment are outlined below.

<table>
<thead>
<tr>
<th>Segment Name</th>
<th>AU</th>
<th>Impairment</th>
<th>Concern</th>
<th>Response Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>2105 Nueces River Above Holland Dam</td>
<td>01</td>
<td>None</td>
<td>Chlorophyll-a</td>
<td>Continue Monitoring</td>
</tr>
<tr>
<td></td>
<td>02</td>
<td>Depressed DO</td>
<td>Depressed DO, Chlorophyll-a</td>
<td>24-hour DO Monitoring, Continue monitoring</td>
</tr>
<tr>
<td></td>
<td>03</td>
<td>None</td>
<td>None</td>
<td>Add monitoring station</td>
</tr>
</tbody>
</table>

In **Segment 2105_01**, the assessment for Chlorophyll-a indicated that 14 out of 23 samples collected did not meet the nutrient screening level of 14.1 µg/L. The average for Chlorophyll-a was 44.32 µg/L.

In **Segment 2105_02**, the assessment indicated that dissolved oxygen levels were consistently low for grab samples. Six out of 24 dissolved oxygen grab samples (25%) failed to meet the criteria (3.0 mg/L) for grab samples and twelve out of 24 (50%) did not meet the screening level criteria (5.0 mg/L) for grab samples resulting in an impaired aquatic life use. Three 24-hour dissolved oxygen levels did meet the average (5.0 mg/L) and minimum (3.0 mg/L). The assessment for Chlorophyll-a indicated that 15 out of 40 samples collected did not meet the nutrient screening level of 14.1 µg/L. The average for Chlorophyll-a was 30.29 µg/L.

**Land Use**
Land use in Segment 2105 is predominantly shrub/scrub (70%) and herbaceous (18%). Woody wetlands (3%), developed open space (3%), cultivated crops (3%), hay/pasture (1%) and developed, low intensity (1%) comprise much of the minor land uses. There are ten permitted dischargers in the segment contributing effluent to tributaries of the Nueces River.

WQ0000546-000 – Del Monte Foods (Crystal City Plant): 1,800,000 gpd via irrigation  
WQ0010098-001 – City of Crystal City: 1,200,000 gpd via Line Oak Slough  
WQ0010145-001 – City of Carrizo Springs: 950,000 gpd via Soldier Slough  
WQ0010153-001 – City of Cotulla: 900,000 gpd via Mustang Creek  
WQ0013746-001 – City of Asherton: 200,000 gpd via Soldier Slough  
WQ0013782-001 – City of Big Wells: 150,000 gpd via Arroyo Negro  
WQ0014006-001 – Zavala County (Crystal City Land Fill): 50,000 gpd via Soldier Slough  
WQ0015047-001 – MacBain Properties Inc.: 14,000 gpd via surface irrigation  
WQ0015049-001 – Qual Run Services LLC: 300,000 gpd via Soldier Slough  
WQ0015058-001 – New Way Land Development, LLC: 200,000 gpd to unnamed tributary

**Possible Causes of Impairments**
The cause for concerns and impairments in Segment 2105 are likely attributed to the number of permitted discharges into the tributaries of the Nueces River. Low flow conditions that are prevalent in the segment do not allow for dilution of nutrient concentrations. Low flow conditions along with high nutrient loads are also the suspected cause for depressed dissolved oxygen levels in the segment.

**Potential Stakeholders**
Landowners: Texas Parks and Wildlife Department  
Local Government: Natural Resource Conservation Service  
Texas State Soil and Water Conservation Board: Texas A&M Agrilife Extension

**Recommended Actions**
Recommendations include moving one of the quarterly monitoring stations from AU_02 to AU_03 to capture water quality conditions in the upper third of the segment. The number of permitted discharges are likely contributing excessive amounts of nutrients in AU_02 resulting in nutrient related listings. During periods of low flow in the segment, which is most of the time, effluent comprises much of the flow. A reduction of nutrients from permitted sources would be beneficial to the receiving waterbody (Nueces River).
Segment 2105_01 - Nueces River above Holland Dam – Station 12975
Nueces River at Interstate Business 35C South of Cotulla
Segment 2105_02 - Nueces River above Holland Dam – Stations 20156
Nueces River Immediately Upstream of SH-85 approximately 12 miles East of Carrizo Springs
The Leona River, which name translates to lioness, was likely named by Alonso de Leon as he searched for La Salle’s troops back in the late 17th Century as the explorer is credited for naming the Nueces, Guadalupe, Trinity and San Marcos rivers in Texas.

Segment Description
Segment 2109, Leona River, flows from central Uvalde County southeast through Zavala County to its confluence with the Frio River near I-35 north of Dilley. The segment is approximately 85 miles long and its watershed is 429,555 acres. Municipalities located within the watershed include the City of Uvalde (population 16,300) and the town of Batesville (population 1,100). Tributaries in the upper reaches of the river near Uvalde include Cooks, Boon, and Taylor sloughs. Gallina Slough, Live Oak, Little Yoledigo and Todos Santo creeks contribute water below Batesville.

<table>
<thead>
<tr>
<th>Segment Name</th>
<th>Station ID</th>
<th>AU</th>
<th>AU Description</th>
<th>Monitoring Entity</th>
<th>Sampling Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2109 Leona River</td>
<td>12985</td>
<td>01</td>
<td>From the downstream end of the segment to the confluence of Yoledigo Creek</td>
<td>TCEQ Region 13</td>
<td>Not monitored</td>
</tr>
<tr>
<td>12987</td>
<td></td>
<td>02</td>
<td>From the confluence of Yoledigo Creek to the confluence of Camp Lake Slough</td>
<td>TCEQ Region 16</td>
<td>Routine Biannually</td>
</tr>
<tr>
<td>18418</td>
<td></td>
<td>03</td>
<td>From confluence of Camp Lake Slough to the upper end of the segment</td>
<td>NRA</td>
<td>Routine Quarterly</td>
</tr>
</tbody>
</table>
Hydrologic Characteristics
Springwater can be seen flowing out of the ground near the crossing of FM-140 just south of Uvalde. The water appearance around the Leona Springs during wet years has a milky blue color due to the fine sediments in the groundwater. In drier years, when Edwards Aquifer levels are low, the river can go dry for long periods of time. Monitoring data from sampling station 18418 was absent from Summer 2009 through Spring 2016 for this reason. Since 2016, streamflow has returned following multiple flood events in the watershed. In 2019, flow averaged around 30 ft³/s.

Water Quality
Segment 2109 is identified in the 2020 IR for not supporting contact recreation and its designated aquatic life use. The segment was first listed for not meeting contact recreation in 2006 and its aquatic life use in 2020. From 2011 to 2012, TIAER performed a Recreational Use Attainability Use Analysis (RUAA) on Segment 2109 to assess the contact recreation standard to see if the presumed uses were appropriate. Interviews from the study indicated that contact recreation (wading by children) does occur. No recreational activities were observed during the field surveys or site visits. The segment also has concerns for elevated nitrate concentrations since 2002.

<table>
<thead>
<tr>
<th>Segment Name</th>
<th>AU</th>
<th>Impairment</th>
<th>Concern</th>
<th>Response Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>2109 Leona River</td>
<td>01</td>
<td>Bacteria</td>
<td>Nitrate</td>
<td>RUAA Completed</td>
</tr>
<tr>
<td></td>
<td>02</td>
<td>Bacteria</td>
<td>Nitrate</td>
<td>RUAA Completed</td>
</tr>
<tr>
<td></td>
<td>03</td>
<td>Depressed Dissolved Oxygen, Bacteria</td>
<td>Depressed Dissolved Oxygen, Nitrate</td>
<td>RUAA Completed</td>
</tr>
</tbody>
</table>

In **Segment 2109_01**, the bacteria impairment in the segment is being carried forward from previous years due to limited assessment data due to low flow conditions. Three of five nitrate samples assessed did not meet the screening level of 1.95 mg/L. Average nitrate exceedance values were 13.20 mg/L.

In **Segment 2109_02**, the geometric mean of 10 samples of *E. coli* bacteria that were assessed was 226.21 MPN, exceeding the criteria of 126 MPN. From 2011 to 2012, Six of ten nitrate samples assessed did not meet the screening level of 1.95 mg/L. Average nitrate exceedance values were 5.36 mg/L.

In **Segment 2109_03**, Nine of fifteen nitrate samples assessed did not meet the screening level of 1.95 mg/L. Average nitrate exceedance values were 3.60 mg/L. The assessment indicated that dissolved oxygen levels were consistently low at monitoring sites in 2019. Eleven out of eleven (100%) grab samples did not meet the screening level (5.0 mg/L) and three out of eleven grab samples did not meet the grab minimum (3.0 mg/L) resulting in a listed impairment. The dissolved oxygen impairment is classified by TCEQ as 5c, meaning additional data will be collected and/or evaluated for one or more parameters before a management strategy is selected. Information from routine quarterly sampling indicate that during periods when the Edwards Aquifer is contributing water to Station 18418, groundwater is flowing out of the ground with very low levels of dissolved oxygen (average value of 3.21 mg/L). During periods where the aquifer is not contributing water, the site is not flowing or is dry. Grab samples from 2019 were all above 5.0 mg/L at Station 18418.

Land Use
Based on satellite imagery, the majority of the land is shrub/scrub (70%), cultivated crops (10%) and herbaceous (10%). Developed, open space (5%), hay/pasture (<2%) and woody wetlands (<2%) make up the rest of the land use in the segment. There are two permitted dischargers in Segment 2109: The City of Uvalde and the Batesville Water Supply Corporation. Three effluent outfalls exist for the City of Uvalde in AU_03. Effluent from outfall 001 discharges into wetland ponds that drain to Cooks Slough, a tributary of Leona River south of Uvalde. Outfall 002 discharges into Uvalde City Park and Municipal Golf Course. Outfall 003 is located near the WWTF and discharges directly into Cooks Slough bypassing the wetland ponds.

WQQ010306-001 – City of Uvalde: 970,000 gpd
WQQ014394-001 – Batesville WSC: 184,000 gpd via Gallina Slough
Possible Causes of Impairments
Causes of water quality impairments (E. coli bacteria and nitrate-nitrogen) in Segment 2109 were evaluated in the Recreational Use Attainability Analysis (RUAA) that was completed by Texas institute of Applied Environmental Research (TIAER) in 2013. In the report, sources were divided into two main categories, regulated and unregulated. Regulated sources include domestic wastewater treatment facilities (WWTF), stormwater discharges from industries, construction, and municipal separate storm sewer systems (MS4s) and concentrated animal feeding operations (CAFOs). Permits for CAFOs are zero discharge for wastewater and manure. Potential unregulated sources include livestock, wildlife and large exotics including feral hogs and failing on-site sewage facilities (OSSFs). An abundance of waterfowl at the community park adjacent to the river in Uvalde contribute nutrients and bacteria in AU_03. Agricultural land use (10% of the total) likely contributes nitrate through fertilizer seepage from fertilized agricultural land.

NRA has noted that spring-water flowing out of the ground at Station 18418 (Leona River at FM-140) is low in dissolved oxygen.

Potential Stakeholders
Landowners
Local Government
Texas State Soil and Water Conservation Board
Texas Parks and Wildlife Department
Natural Resource Conservation Service
Texas A&M Agrilife Extension

Recommended Actions
Due to a lack of streamflow at many of the sampling locations from 2009 through 2016, data in the 2020 Integrated Report (period of record is 2011 – 2018) comes from a small dataset. It is recommended to continue to monitor to obtain enough data for a full assessment.
Segment 2109_01 – Leona River – Stations 12985
Leona River at FM 1581 Southwest of Pearsall

Segment 2109_02 – Leona River – Stations 12987
Leona River at US-57 near Batesville
Segment 2109_03 – Leona River – Stations 18418
Leona River 370 M Upstream of FM-140

USGS 08204005 Leona Rv nr Uvalde, TX

Discharge, cubic feet per second

Period of approved data

Discharge
The name Sabinal comes from the Spanish word for a grove of bald cypress (\textit{Taxodium distichum}) trees that line the banks of the river. The Lower Sabinal River is home to the southernmost stand of bald cypress trees in the Nueces River Basin.

**Segment Description**
The Lower Sabinal River flows 27 miles from a point 100m upstream of SH 127 to the confluence with the Frio River in Uvalde County. Its watershed is 136,676 acres and the City of Sabinal (population 1,696) is the only community in the watershed.

<table>
<thead>
<tr>
<th>Segment Name</th>
<th>Station ID</th>
<th>AU</th>
<th>AU Description</th>
<th>Monitoring Entity</th>
<th>Sampling Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2110 Lower Sabinal River</td>
<td>12993</td>
<td>01</td>
<td>From the confluence with the Frio River in Frio County to a point 100m upstream of SH-127 in Uvalde County</td>
<td>NRA</td>
<td>Routine Quarterly</td>
</tr>
</tbody>
</table>

**Hydrologic Characteristics**
The Lower Sabinal River more closely resembles a collection of pools than it does a flowing river. Water sourced from the Upper Sabinal River courses underground in sections leaving a bare cobble streambed dotted with large pools. Pools in the segment are typically lined with bald cypress trees and are the result of scouring by flood flows. There is one USGS streamflow gaging station on the Lower Sabinal River. USGS 08198500 is located at the bridge crossing at US-90 and serves as a location (Station 12993) where routine quarterly samples are collected. Median instantaneous streamflow at the site based on 67 years of data is 1.4 feet$^3$/sec.

**Water Quality**
Segment 2110 was listed as being impaired for nitrates in the 2002 Integrated Report. The suspected source was the Sabinal wastewater treatment plant (WWTP) which was subject to inundation during floods. A TMDL was conducted and an Implementation Plan was approved in 2005. The plan called for the construction of a new plant which has been completed and came online on July 27, 2011. The status of the waterbody changed from “not supporting” to “of concern” in the 2014 Integrated Report. Nitrates are being carried forward as a parameter of concern in the 2020 Integrated Report. Visible evidence of nutrient enrichment is often noted on site visits as an abundance of floating and submerged algae is generally present. Floating algae typically submerges as the
water temperature drops in fall and winter months. Elevated nitrate concentrations create conditions that make it difficult for aquatic species to thrive. An abundance of algae can cause dissolved oxygen concentrations to fluctuate, for aquatic species to thrive. An abundance of algae can cause dissolved oxygen concentrations to fluctuate, rising during the days and falling at night. As the algae die off, dissolved oxygen gets consumed due to the decomposition process.

<table>
<thead>
<tr>
<th>Segment Name</th>
<th>AU</th>
<th>Impairment</th>
<th>Concerns</th>
<th>Response Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>2110</td>
<td></td>
<td>01</td>
<td>None</td>
<td>Continue Monitoring</td>
</tr>
<tr>
<td>Lower Sabinal River</td>
<td></td>
<td></td>
<td>Depressed Dissolved Oxygen</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Nitrate-Nitrogen</td>
<td>WWTP moved in 2011</td>
</tr>
</tbody>
</table>

In Segment 2110_01 – Lower Sabinal River – Station 12993, the 2020 IR assessment for depressed dissolved oxygen indicated that three out of 10 samples collected had a value of 4.20 mg/L failing to meet the dissolved oxygen screening levels of 5.0 mg/L for grab samples. Nitrate-nitrogen exceeded the nutrient screening level criteria of 1.95 mg/L in all 18 samples collected. The mean exceedance value was 6.63 mg/L.

**Land Use**

Land use in the lower Sabinal River watershed is mainly shrub/scrub (52%), herbaceous (17%), and cultivated crops (15%). Evergreen forest (7%), developed open space (5%) and deciduous forest and woody wetland (2%) make up much of the rest. There is one permitted discharger in the upper end of the segment for the City of Sabinal (Q0014689-001 – City of Sabinal: 340,000 gpd) that discharges to an unnamed tributary of the river.

**Possible Causes of Impairments**

The source of nitrate-nitrogen can come from many sources in the landscape including municipal and industrial wastewater treatment facilities, on-site sewage facilities (septic systems), seepage from fertilized agricultural land, animal feedlots, decaying plant debris and wildlife. Depressed dissolved oxygen values are typically associated as a response to elevated nutrient concentrations.

**Potential Stakeholders**

- Landowners
- Local Government
- Texas State Soil and Water Conservation Board
- Texas Parks and Wildlife Department
- Natural Resource Conservation Service
- Texas A&M Agrilife Extension

**Recommended Actions**

Texas Hill Country streams are very sensitive to nutrient inputs. Evaluations of water quality in the segment indicate nutrient enrichment of the waterbody is still occurring. It is likely that low flow conditions that are typical in the segment are insufficient to receive nutrient inputs at current rates. Therefore, a reduction of nitrate sources is required to meet screening levels. An evaluation of sources and contributions of nitrate is recommended including the possibility of transitioning the City of Sabinal to a land application only permit for its WWTP.
Segment 2110.01 – Lower Sabinal River – Stations 12993
Sabinal River Bridge at US-90 West of Sabinal

USGS 08198500 Sabinal Rv at Sabinal, TX

Discharge, cubic feet per second

- Discharge
- Period of approved data
The Upper Sabinal River was once known as the Arroyo de la Soledad, which means “stream of solitude” in Spanish. How it got this name is no mystery to the people who know it. Today the river is known as the Sabinal which translates to a “grove of bald cypress trees”, which are a trademark of many of the hill country spring-fed streams. The source of the Upper Sabinal River is some of the best water quality in the state but due to predominantly low flows, the river is also very sensitive to nutrient inputs from a variety of sources.

**Segment Description**

The segment flows 48 miles from the most upstream crossing FM 187 in Bandera County to a point 100m upstream of SH 127 in Uvalde County. It is divided into two AUs; from the downstream end to the confluence with the West Sabinal River (AU_01), and from the confluence with the West Sabinal River to the upstream end (AU_02). Its watershed is 149,444 acres. The Cities of Utopia and Vanderpool are the only communities in the watershed. Lost Maples State Park is near the headwaters. Bandera County River Authority and Groundwater District (BCRAGD) became a CRP sub-participant in FY 2016 to help NRA with sampling in AU_02 of the Upper Sabinal River. They are contributing their resources for this sampling and providing the data to NRA for submittal.

<table>
<thead>
<tr>
<th>Segment Name</th>
<th>Station ID</th>
<th>AU</th>
<th>AU Description</th>
<th>Monitoring Entity</th>
<th>Sampling Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2111 Upper Sabinal River</td>
<td>12994</td>
<td>01</td>
<td>From the downstream end of the segment to the confluence with the West Sabinal River</td>
<td>BCRAGD</td>
<td>Quarterly</td>
</tr>
<tr>
<td></td>
<td>14939</td>
<td>02</td>
<td>From the confluence with the West Sabinal River to the upstream end of the segment</td>
<td>BCRAGD</td>
<td>Quarterly</td>
</tr>
</tbody>
</table>
Hydrologic Characteristics
Unlike many other spring-fed Texas hill country streams, streamflow on the Upper Sabinal is generally insufficient for recreational activities such as tubing although numerous swimming holes do exist. Streamflow in Segment 2111 is monitored by two USGS gage stations. USGS 08197936 is located near Vanderpool and USGS 08197970 is located approximately nine miles south of Utopia. The area along the Balcones fault is subject to devastating flash floods due to the steep topography in the upper reaches of the river. The river has also been known to go dry during prolonged drought.

Water Quality
Water quality analysis using data from Station 12994 in AU_01 and Station14939 in AU_02 shows no water quality concerns or impairments in the 2020 IR. AU_01 had three exceedances out of 16 samples for low dissolved oxygen but the average (4.3 mg/L) was well above the minimum for grab samples (3.0 mg/L). AU_02 had no exceedances for any of the parameters tested.

<table>
<thead>
<tr>
<th>Segment Name</th>
<th>AU</th>
<th>Impairment</th>
<th>Concern</th>
<th>Response Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Sabinal River</td>
<td>01</td>
<td>None</td>
<td>None</td>
<td>Continue Monitoring</td>
</tr>
<tr>
<td></td>
<td>02</td>
<td>None</td>
<td>None</td>
<td>Continue Monitoring</td>
</tr>
</tbody>
</table>

In Segment 2111_01 – Upper Sabinal River – Station 21948, the 2020 IR indicated for dissolved oxygen that two out of 16 samples collected had a value of 4.30 mg/L failing to meet the dissolved oxygen screening levels of 5.0 mg/L for grab samples. However, exceedance values were insufficient to result in a water quality concern or impairment.

In Segment 2111_02 – Upper Sabinal River – Station 14939, the 2020 Integrated Report indicated that all water quality parameters meet their respective criteria without any exceedance values in the reporting period (2011 through 2018).

Land Use
Land use in the Upper Sabinal River watershed is primarily Evergreen forest (44%), shrub/scrub (37%) and herbaceous (11%). Developed open space (2.6%), deciduous forest (2.5%), cultivated crops (1.7%) and woody wetlands (<0.5%) make up the remainder of the uses. There is one permitted effluent source in the segment, located at Lost Maples State park (WQ0011951-001: 8,000 gpd via surface irrigation), but it doesn’t discharge to the river.

Potential Stakeholders
Landowners
Local Government
Texas State Soil and Water Conservation Board
Texas Parks and Wildlife Department
Natural Resource Conservation Service
Texas A&M Agrilife Extension

Recommended Actions
It is recommended that BCRAGD keep monitoring current at both stations. Data gaps related to drought have limited the dataset so additional data is needed for future assessments. In addition, due to low flow conditions that persist in the segment, additional nutrient inputs from permitted sources including wastewater treatment plants are not advised.
Segment 2111_01 – Upper Sabinal River – Station 21948
Sabinal River 12.5 miles North of Sabinal and 2.3 miles Downstream from the Mouth of Onion Creek
Segment 2111_02 – Upper Sabinal River – Station 14939
Sabinal River at FM-187 5.6 miles South of Vanderpool
Spanish explorer Alonso de Leon is credited for naming the Nueces River after observing nuts (nueces) floating down the river in the 17th century. The nuts observed were from walnut and pecan trees that were common along the banks. The Nueces River is one of the streams that lacks the majestic Bald Cypress (Taxodium distichum) that are a trademark of many Texas Hill Country streams. Headwater tributaries include Hackberry, Bullhead, Pulliam and Camp Wood creeks on the East Prong of the Nueces River. Camp Wood is the only town located in the segment.

**Segment Description**
The Upper Nueces River (Segment 2112) begins its course in the Edwards Plateau near Rock Springs at an elevation of approximately 2,220 feet above sea level. The segment flows 123 miles from the confluence of the East Prong Nueces River and Hackberry Creek in Edwards County to a point 100m (110 yards) upstream of FM 1025 in Zavala County. It is divided into four AUs; from the downstream end to the confluence with Sand Ridge Creek (AU_01), from the confluence with Sand Ridge Creek to just downstream of US 90 (AU_02), from just downstream of US 90 the confluence with Miller Creek (AU_03), and from the confluence with Miller Creek to the upstream end. Its watershed is 1,336,006 acres. There are several small communities in the watershed. All assessed parameters met the standards in the 2020 IR assessment with the exception of AU_01 with a concern for depressed dissolved oxygen.

<table>
<thead>
<tr>
<th>Segment Name</th>
<th>Station ID</th>
<th>AU</th>
<th>AU Description</th>
<th>Monitoring Entity</th>
<th>Sampling Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2112 Upper Nueces River</td>
<td>17143</td>
<td>01</td>
<td>From the downstream end to the confluence with Sand Ridge Creek</td>
<td>TCEQ Region 16</td>
<td>Quarterly</td>
</tr>
<tr>
<td></td>
<td>12996</td>
<td>02</td>
<td>From the confluence with Sand Ridge Creek to the confluence with unnamed tributary just downstream of US Hwy 90</td>
<td>TCEQ Region 16</td>
<td>Bi-annually</td>
</tr>
<tr>
<td></td>
<td>12997</td>
<td>03</td>
<td>From the confluence with unnamed tributary just downstream of US Hwy 90 to the confluence with Miller Creek</td>
<td>TCEQ Region 16</td>
<td>No current sampling</td>
</tr>
<tr>
<td></td>
<td>16704</td>
<td>04</td>
<td>From the confluence with Miller Creek to the upper end of the segment</td>
<td>NRA</td>
<td>Quarterly</td>
</tr>
<tr>
<td></td>
<td>13005</td>
<td>04</td>
<td>From the confluence with Miller Creek to the upper end of the segment</td>
<td>NRA</td>
<td>No current sampling</td>
</tr>
</tbody>
</table>
Hydrologic Characteristics
The source-water of the upper Nueces River comes from a number of small tributaries in Real and Edwards counties. Tributaries such as Hackberry, Bullhead, Pulliam and Campwood creeks drain the Edward’s Plateau providing water in the east prong of the Nueces River. The West Prong of the River is more ephemeral in nature, largely only providing flow in conjunction with rain events. Much of the streamflow in the upper half of the segment traverses though the Edward’s Aquifer recharge zone in Kinney and Uvalde counties.

Streamflow in Segment 2112 is measured by the USGS at six locations. Flow stations are located at Barksdale, Montell and Laguna on the East Prong and at Brackettville on the West Prong. Below the confluence of the east and west prongs, gages are located below Uvalde and near Crystal City (water level only). In between rain events, flows range from 10 to 100 ft³/sec. During periods of drought, isolated pools dot the riverbed with much of the water flowing underground between pools. As the riverbed progresses downstream, a significant portion of the water enters through fractures in the limestone of the Edwards Aquifer recharge zone. Downstream of the Edwards Aquifer, flows are largely influenced by rain events that provide significant runoff.

The Upper Nueces River, due to its steep topography, is susceptible to incredible and destructive flash flood events that can send the river levels up very quickly. Water rapidly flows from the headwaters to the brushlands of the South Texas Plains located in the lower end of the segment. Transit time for flood flows from the Barksdale gage take approximately 14 hours to make it to the Nueces River below Uvalde gage.

Water Quality
Water quality in the headwaters and upper end of the segment is exceptional with crystal-clear springs providing a steady flow of water in all but the driest of years. No concerns or impairments exist in AUs 02 through 04. AU_01, located at the bottom of the segment, has a water quality concern for depressed dissolved oxygen based on the draft 2020 IR.

<table>
<thead>
<tr>
<th>Segment Name</th>
<th>AU</th>
<th>Impairment</th>
<th>Concern</th>
<th>Response Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>2112 Upper Nueces River</td>
<td>01</td>
<td>None</td>
<td>Dissolved Oxygen</td>
<td>Continue Monitoring</td>
</tr>
<tr>
<td></td>
<td>02</td>
<td>None</td>
<td>None</td>
<td>Add monitoring station</td>
</tr>
<tr>
<td></td>
<td>03</td>
<td>None</td>
<td>None</td>
<td>Continue Monitoring</td>
</tr>
<tr>
<td></td>
<td>04</td>
<td>None</td>
<td>None</td>
<td>Add monitoring station</td>
</tr>
</tbody>
</table>

In Segment 2112_01 – Upper Nueces River – Station 17143 and 12996, the 2020 Integrated Report indicated that for dissolved oxygen, seven out of 29 samples collected had a value of 3.84 mg/L failing to meet the dissolved oxygen screening levels of 5.0 mg/L for grab samples. One out of 29 samples collected had a value of 2.53 mg/L and did not meet the minimum dissolved oxygen screening level of 3.0 mg/L.

In Segment 2112_02 – Upper Nueces River – Station 12997, the 2020 Integrated Report indicated that all water quality parameters meet their respective criteria without any exceedance values in the reporting period (2011 through 2018).

In Segment 2112_03 – Upper Nueces River – Station 16704, the 2020 Integrated Report indicated that all water quality parameters meet their respective criteria without any exceedance values in the reporting period (2011 through 2018).

In Segment 2112_04 – Upper Nueces River – Station 13005, the 2020 Integrated Report indicated that all water quality parameters meet their respective criteria without any exceedance values in the reporting period (2011 through 2018).

Land Use
The majority of the land use in Segment 2112 is Shrub/scrub (71%), evergreen forest (14%), deciduous forest (5%) and herbaceous (5%). Developed open space (<2%) and cultivated crops (<2%) account for a small portion of the mostly rural watershed. There are several small communities in the segment. Camp Wood (pop. 726) and Barksdale (pop. 104) are in the upper reaches of the segment and La Pryor (pop. 1,530) and Crystal City (pop. 7,246) are located in the lower portion of the segment.

WQ0012334-001 – City of Camp Wood: 101,000 gpd via surface irrigation
WQ0014367-002 – Zavala County WCID: 330,000 gpd via surface irrigation
WQ0015502-001 – Camp Eagle I Rock Springs: 40.000 gpd via East Prong of Nueces River
Possible Causes of the Concern
Episodes of low dissolved oxygen can be attributed to a number of causes including nutrient enrichment, stagnant water, elevated temperature and biological and/or chemical oxygen demand. The 2020 IR data assessment for AU_01 indicates that nitrate and chlorophyll-a levels are at times slightly elevated. One exceedance for nitrate and three exceedances for chlorophyll-a were recorded the period of record (2011 through 2018) for the assessment. It is likely that a combination of low levels of nutrient enrichment combined with variable streamflow rates are the root causes of the depressed dissolved oxygen concern.

Potential Stakeholders
Landowners
Local Government
Texas State Soil and Water Conservation Board
Texas Parks and Wildlife Department
Natural Resource Conservation Service
Texas A&M Agrilife Extension

Recommended Actions
It is recommended that NRA and TCEQ keep monitoring current at all stations. Hill country streams are historically very low in nutrients in the upper reaches so inputs should be kept at a minimum to protect water quality. It is recommended that permitted discharges such as WWTPs be required to apply for land application instead of direct discharge to the river whenever possible.
Segment 2112_01 – Upper Nueces River – Station 17143
Lake Averhoff/Upper Nueces Lake near FM 1025/FM 3292

Segment 2112_01 – Upper Nueces River – Station 12996
Nueces River at US HWY 57
Segment 2112_02 – Upper Nueces River – Station 12997
Nueces River just downstream of US-83 South of Uvalde
The Frio River was originally named Rio Zarco by Spanish explorer Alonso de Leon in 1689. The name which means “blue” is likely due to the river’s many deep blue swimming holes. The river was eventually renamed the Frio River “cold river”. Recreational activities are very popular in the segment. Garner State Park receives between 300,000 and 400,00 visitors on an annual basis. Concarn is another destination popular for summertime recreation activities.

Segment Description
The segment flows 47 miles from the confluence with the West Frio River and the East Frio River in Real County to a point 100m upstream of US 90 in Uvalde County. It is divided into two AUs; from the downstream end to the confluence with Bear Creek (AU_01), and from the confluence with Bear Creek to the upstream end (AU_02). Its watershed is 280,596 acres. Towns in the watershed include Leakey and Concan which have significant seasonal variations in population due to recreation on the river.

<table>
<thead>
<tr>
<th>Segment Name</th>
<th>Station ID</th>
<th>AU</th>
<th>AU Description</th>
<th>Monitoring Entity</th>
<th>Sampling Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2113 Upper Frio River</td>
<td>13006</td>
<td>01</td>
<td>From the downstream end to the confluence with Bear Creek</td>
<td>TCEQ Region 13</td>
<td>Bi-annually</td>
</tr>
<tr>
<td>13007</td>
<td>02</td>
<td>From the confluence with Bear Creek to the upstream end</td>
<td>TCEQ Region 13</td>
<td>No Current Sampling</td>
<td></td>
</tr>
</tbody>
</table>

Hydrologic Characteristics
Streamflow in the Upper Frio River is sourced from numerous spring-fed tributaries located north of the town of Leakey in Real County. There are two stream gages operated by the USGS. USGS 08195000, located in Concarn (AU_01) shows a median instantaneous flow rate of 74 ft³/sec based on 94 years of record. Streamflow from the springs varies significantly from year to year. Dry years will see the flow drop to below 20 ft³/s and in rare cases to zero or close to zero. USGS 08194840, located in Leakey (AU_02), reports gage height and precipitation parameters only. Segment 2113 is prone to flash flood events that can become very dangerous to people, property and livestock. Flash floods scour out deep pools or change the course of the river while uprooting trees and depositing them along the river bank.
Water Quality

This segment was originally placed on the 303(d) list in 1999 for impairments to aquatic life use because it did not meet the minimum criteria for depressed dissolved oxygen. Segment 2113 was included as part of an impairment verification monitoring project through the TCEQ TMDL Program to evaluate several south-central Texas streams. Twenty-four hour dissolved oxygen data and biological data were collected and a report was released in 2004. The data from the TMDL study were evaluated as part of the 2006 Texas Integrated Report and resulted in de-listing segment 2113 for depressed dissolved oxygen. However, both assessment units were impaired for fish and habitat. Assessment unit 2113_01 was also impaired for macrobenthic fauna. A revision to the assessment procedures resulted in the segment-wide de-listing for habitat in 2008. In the 2010 Texas Integrated Report AU 2113_02 was delisted for impaired fish community.

<table>
<thead>
<tr>
<th>Segment Name</th>
<th>AU</th>
<th>Impairment</th>
<th>Concern</th>
<th>Response Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>2113 Upper Frio River</td>
<td>01</td>
<td>Impaired fish community, Impaired macrobenthic community</td>
<td>Impaired Habitat</td>
<td>Aquatic Life Monitoring</td>
</tr>
<tr>
<td></td>
<td>02</td>
<td>None</td>
<td>Impaired habitat, Impaired fish community</td>
<td>Aquatic Life Monitoring</td>
</tr>
</tbody>
</table>

In response to the impairments and concerns TCEQ conducted aquatic life monitoring (ALM) biological sampling events to evaluate biological and habitat health. ALMs require two monitoring events to be completed before an evaluation can be made. The first ALM occurred in April 2017 and the second one in September 2019. The results will be used to reassess the impairments and concerns.

In **Segment 2113_01 – Upper Frio River – Station 13006**, the 2020 Integrated Report indicated that all water quality parameters meet their respective criteria without any exceedance values during the reporting period (2011 through 2018). Historic impairments for fish and macrobenthic communities and concerns for impaired habitat are carried forward until the results from the ALM can be used to re-evaluate the segment.

In **Segment 2113_02 – Upper Frio River – Station 13007**, the 2020 Integrated Report indicated that all water quality parameters meet their respective criteria without any exceedance values in the reporting period (2011 through 2018). Historic concerns for impaired habitat and fish community are carried forward until the results from the ALM can be used to re-evaluate the segment.
Land Use
Land use in the Upper Frio River is largely composed of shrub/scrub brush (45%), evergreen forest (40%), herbaceous (7%) and deciduous forest (5%). Developed open space accounts for approximately 2% of the land use. There are three permitted dischargers in the upper and middle portion of Segment 2113; the Alto Frio Baptist encampment, TPWD and the wastewater treatment plant operated by Nueces River Authority. Wastewater effluent at these facilities are permitted for irrigation use only.

WQ0011683-001 – Alto Frio Baptist Encampment: 20,000 gpd via surface irrigation
WQ0011962-001 – Texas Parks and Wildlife Department: 60,000 gpd via surface irrigation
WQ0015083-001 – NRA: 360,000 gpd via surface irrigation

Possible Causes of Impairments
Water quality in Segment 2113 is very good based on the latest data assessed in the 2020 Integrated Report. Historical impairments related to depressed dissolved oxygen were delisted in previous assessments and biological and habitat are being re-evaluated with new data that will used in the 2022 Integrated Report.

Potential Stakeholders
Landowners
Local Government
Texas State Soil and Water Conservation Board

Texas Parks and Wildlife Department
Natural Resource Conservation Service
Texas A&M Agrilife Extension

Recommended Actions
Following the completion of the Upper Frio River ALM study, TCEQ will determine if the concerns and impairments will carry forward in a future water quality assessment. A continuation of routine water quality monitoring is recommended to keep the dataset for Segment 2113 current. Additionally, based on the recreational value and lack of other water quality impairments, it is recommended that any future wastewater treatment plant permits should be for land application only. Like other spring-fed water bodies, nutrient inputs to the stream can result in a degradation of water quality and appearance.
Segment 2113.01 – Upper Frio River – Station 13006
Frio River at SH-127 East of Concan

USGS 08195000 Frio Rv at Concan, TX

Discharge, cubic feet per second

- Discharge
- Period of approved data
Hondo Creek is named after the Spanish word for "deep". Hondo Creek runs from the southern portion of Bandera County near Tarpley to its mouth at the Frio River near Pearsall. It makes its way through the steep slopes of the Texas Hill Country to the gently rolling hills and fertile croplands in Frio County. The creek is spring fed in the upper reaches and intermittent in the middle reaches of the segment.

**Segment Description**

The segment flows 78 miles from FM 470 in Bandera County to the confluence with the Frio River in Frio County. It is divided into two AUs; from the downstream end to just upstream of FM 2676 (AU_01), and from just upstream of FM 2676 to the upstream end (AU-02). Its watershed is 435,985 acres.

<table>
<thead>
<tr>
<th>Segment Name</th>
<th>Station ID</th>
<th>AU</th>
<th>AU Description</th>
<th>Monitoring Entity</th>
<th>Sampling Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hondo Creek</td>
<td>18408</td>
<td>01</td>
<td>From downstream end to just upstream of FM 2676</td>
<td>NRA</td>
<td>Quarterly</td>
</tr>
<tr>
<td></td>
<td>13010</td>
<td>02</td>
<td>150 m downstream of RR 462 near Tarpley</td>
<td>TCEQ Region 13</td>
<td>Bi-annually</td>
</tr>
</tbody>
</table>

**Hydrologic Characteristics**

There are two streamflow gages on Hondo Creek operated by the USGS. USGS 08200000 is located in the upper portion of the segment approximately 8 miles south of Tarpley on FM 462. Streamflow measurements from the Tarpley gage show a median instantaneous flow rate of 12 ft³/sec base on 67 years of record. USGS 08200720 gage is located off SH 173 near the town of Hondo. Although there is a large pool that maintains water at the sampling location, streamflow measurements from the USGS show a median flow rate of zero ft³/sec.

**Water Quality**

In 2012, the water quality assessment for the segment indicated an impairment due to elevated chloride levels. In 2014, the segment also became impaired for Total Dissolved Solids (TDS). Nitrate has been a parameter of concern in AU_01 since 2010. The chloride and TDS impairments were delisted in the 2018 IR but the site maintains a concern for nitrate nitrogen in the 2020 IR.
<table>
<thead>
<tr>
<th>Segment Name</th>
<th>AU</th>
<th>Impairment</th>
<th>Concern</th>
<th>Response Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>2114 Hondo Creek</td>
<td>01</td>
<td>None</td>
<td>Nitrate</td>
<td>Continue monitoring</td>
</tr>
<tr>
<td></td>
<td>02</td>
<td>None</td>
<td>None</td>
<td>Continue monitoring</td>
</tr>
</tbody>
</table>

In **Segment 2114_01 - Hondo Creek – Station 18408**, the geometric mean of 20 samples of nitrate nitrogen that were assessed was 3.47 mg/L, exceeding the screening level criteria of 1.95 mg/L. The exceedance resulted in a water quality concern for this parameter.

In **Segment 2114_02 – Hondo Creek – Station 13010**, the 2020 Integrated Report indicated that all water quality parameters meet their respective criteria without any exceedance values during the reporting period (2011 through 2018).

**Land Use**
Land use in Hondo Creek is comprised of shrub/scrub brush (37%), evergreen forest (23%), herbaceous (18%), cultivated crops (8.3%), deciduous forest (6.0%), developed open space (4.7%) and hay/pasture (<2%). There are two permitted dischargers to creeks that flow into Segment 2114. The City of Hondo (population est. 9,387) and the Camp of the Ozarks (RR 417 LLC) both discharge to this segment. The Hondo Vitreous China Plant is a permitted facility but does not discharge into a stream.

WQ0001645-000 – Crane Plumbing Hondo Vitreous China Plant: 30,000 gal/day via evaporation
WQ0010189-001 – City of Hondo: 1,800,000 gpd via Elm Slough
WQ0015713-001 – RR 417 LLC: 49,000 gal/day via Commissioner’s Creek

**Possible Causes of Concern**
Potential causes of the nitrate concern include: fertilizer from agricultural activities, on site sewage treatment facilities (OSSFs) leaching into the groundwater, wastewater treatment plant effluent and wildlife.

**Potential Stakeholders**
Landowners
Local Government
Texas State Soil and Water Conservation Board

Texas Parks and Wildlife Department
Natural Resource Conservation Service
Texas A&M Agrilife Extension

**Recommended Actions**
Due to a water quality concern for nitrate nitrogen in the lower end of the segment (AU_01), a continuation of monitoring is recommended to keep the dataset current. A new water quality monitoring station in the upper reaches of the segment on Commissioner’s Creek is recommended due to feedback from concerned stakeholders following TCEQ investigations in 2019 related to water quality disturbances that occurred during the construction of Camp of the Ozarks (permit RR 417 LLC). The camp discharges domestic wastewater to the springfed creek.
Segment 2114 02 – Hondo Creek – Station 13010
Hondo Creek at RR-462 near Tarpley

USGS 08200000 Hondo Ck nr Tarpley, TX

Discharge, cubic feet per second

- Discharge
- Period of approved data
Segment 2115: Seco Creek

Seco creek, meaning “dry creek” in Spanish arises in Bandera County. The picturesque but low-flow spring-fed creek is situated between the Sabinal River on the west and Hondo Creek to the east. The creek is bordered by large ranches and goes underground into the Edward’s Aquifer before it reaches its confluence with Hondo Creek in Frio County.

Segment Description
It is divided into two AUs; from the downstream end to the confluence with an unnamed tributary near FM 1796 (AU_01), and from the confluence with an unnamed tributary near FM 1796 to the upstream end (AU_02). Its watershed is 266,833 acres. There are no sampling sites in AU_01 due to a lack of consistent water. BCRAGD has conducted routine water quality sampling in AU-02 since FY 2016. They are contributing their resources for this sampling and providing the data to NRA for submittal to the State’s SWQMIS database.

<table>
<thead>
<tr>
<th>Segment Name</th>
<th>Station ID</th>
<th>AU</th>
<th>AU Description</th>
<th>Monitoring Entity</th>
<th>Sampling Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2115 Seco Creek</td>
<td>N/A</td>
<td>01</td>
<td>From the downstream end to the confluence with an unnamed tributary near FM 1796</td>
<td>N/A</td>
<td>No current sampling</td>
</tr>
<tr>
<td>13013</td>
<td></td>
<td>02</td>
<td>From the confluence with an unnamed tributary near FM 1796 to the upstream end</td>
<td>NRA</td>
<td>No current sampling</td>
</tr>
<tr>
<td>13017</td>
<td></td>
<td></td>
<td></td>
<td>BCRAGD</td>
<td>Quarterly</td>
</tr>
</tbody>
</table>
Hydrologic Characteristics
Seco Creek springs from the Balcones Escarpment in southwestern Bandera County flowing until it reaches the lower portions of the creek where it permeates underground into the Edward’s Aquifer. Streamflow is monitored by the USGS at two locations. In the lower reach of the creek, USGS 08202700, located on Rowe Ranch north of D’Hanis is typically dry. Flows are typically observed in conjunction with significant rain events. Median instantaneous flow during the historical record was 0 ft³/sec based on 58 years of record. In the upper reach, the creek is gaged by USGS 08201500 located on Miller Ranch. Numerous springs contribute to a median instantaneous flow of 5 ft³/sec based on 58 years of record.

Water Quality Assessment
Water quality in the upper reaches of Seco Creek is of very high quality. No concerns or impairments are listed in the 2020 IR.

<table>
<thead>
<tr>
<th>Segment Name</th>
<th>AU</th>
<th>Impairment</th>
<th>Concern</th>
<th>Response Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>2115 Seco Creek</td>
<td>01</td>
<td>None</td>
<td>None</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>02</td>
<td>None</td>
<td>None</td>
<td>Continue Monitoring</td>
</tr>
</tbody>
</table>

In Segment 2115_01 – Seco Creek – Station 13013 the 2020 Integrated Report indicated that all water quality parameters meet their respective criteria without any exceedance values during the reporting period (2011 through 2018).

In Segment 2115_02 – Seco Creek – Station 13017 the 2020 Integrated Report indicated that all water quality parameters meet their respective criteria without any exceedance values during the reporting period (2011 through 2018).

Land Use
Based on satellite imagery, the majority of the land use in the segment is shrub/scrub brush (51%), evergreen forest (21%) and herbaceous (15%). Relatively minor land uses include developed open space (4.6%), cultivated crops (4.4%) and deciduous forest (2.8%). There are no major towns in the watershed, only ranches, many of significant size. There is one permitted discharger to the creek located in the lower reach of the creek just downstream of U.S. Hwy 90.

WQ0011144-001 – Medina County WCID 002: 80,000 gpd treated domestic wastewater to Seco Creek

Potential Stakeholders
Landowners
Local Government
Texas State Soil and Water Conservation Board
Texas Parks and Wildlife Department
Natural Resource Conservation Service
Texas A&M Agrilife Extension

Recommended Actions
Due to a lack of identified water quality concerns and/or impairments in the creek, diligence must be made to preserve water quality in this low-flow, spring-fed stream. Nutrient inputs from sources such as on-site sewage facilities (septic systems), fertilizer runoff, waste from wildlife and livestock can affect water quality.
Segment 2115_02 – Seco Creek - Station 13017
Seco Creek at SH-470

BCRAGD personnel conducting streamflow measurements at 13017
CONTACT INFORMATION

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NRA would like to recognize and thank our CRP partners for their support and contributions to the program. NRA would like to recognize and dedicate this report to my stepbrother, Thomas James “TJ” Avery (1974-2020). His photograph of the Sabinal River at Utopia (page 33) captured the essence of this Texas Hill Country stream.